Assignment 04

Due: Thursday, October 18, 2012 at 11:59 p.m.

- Do **not** use reverse or member in any of your solutions.
- Since you are using Beginning Student Scheme, you may not use list abbreviations on this assignment.

- You may want to includ help reduce the writing for the examples and tests.
- For this and all subsequ are expected to use the design recipe when writing functions from scratch. Be sure to follo design recipe, including the definition of constants and helper functions, that include re appropriate.
- Do not copy the purpos ignment description. The purpose should be written in your own words and include refe r names of your functions.
- The solutions you subm ur own work. Do not look up either full or partial solutions on the Internet or in printed sources.
- Do not send any code files by email to any course staff. It will not be accepted by course staff as an assignment submission. Course staff will not debug code emailed to them.
- Test data for all questions will always meet the stated assumptions for consumed values.
- Read each question carefully for restrictions.
- Read the course Web page for more information on assignment policies and how to organize and submit your work. Follow the instructions in the style guide. Specifically, your solutions should be placed in files a04qY.rkt, where Y is a value from 1 to 3.
- Download the interface file from the course Web page.

Language level: Beginning Student
Coverage: Module 5 (simple lists)

1. Using structural recursion, write a function called `calc-sqrt` that consumes a list of numbers (`lon`) and produces a list of elements, where each element in the list produced is one of:
   - the positive square root of the number in `lon`, where the number in `lon` is a non-negative integer and its square root is also an integer
   - the symbol `'irrational`, where the number in `lon` is a positive integer, but its square root is a non-integer
   - the symbol `'imaginary` for all negative numbers in `lon`

   In the case where the element is positive non-integers, there is no matching entry in the list that is produced. The list produced contains the matching values in the same relative order as the original list.

   For example,
   ```
   (calc-sqrt (cons 4 (cons 0 (cons 1.3 (cons 5 (cons -1 (cons -1.3 empty))))))
   ```
   produces
   ```
   (cons 2 (cons 0 (cons 'irrational (cons 'imaginary (cons 'imaginary empty)))))
   ```

2. Using structural recursion, write a function called `string->ascii` that consumes a string (`phrase`), and produces a list of natural numbers representing ASCII codes of characters of `phrase`, that matches the characters in the order they appear in the string. For example,
   `(string->ascii "Hi!")` produces `(cons 72 (cons 105 (cons 33 empty)))`

   If `phrase` is the empty string (`""`), the function should produce the `empty` list. The built-in function `char->integer` consumes a character and produces an integer in the range 0 … 255 and matching the

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ASCII code value of the character consumed. This function may be helpful.

3. The terms of a geometric [illegible] value a, with common ratio r would be:

   $a, a \cdot r, a \cdot r^2, a \cdot r^3, \ldots$

   Neither a nor r may have [illegible]mple, a geometric sequence starting at 4 with a common ratio of $\frac{1}{2}$ would be:

   $4, 2, 1, \frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \ldots$

   Using structural recursion, write a function called `geo-seq?` that consumes a list of numbers and produces `true` when the numbers in the list (in their current order) form a geometric sequence and `false` otherwise. An empty list should produce `false`. A list with one or two elements should produce `true`, as long as neither of the elements are 0. Hint, think carefully how you can determine if any two adjacent values in the list are part of a geometric sequence.